

# DOE/BPA DG Workshops for Code Officials

IdaTech, LLC  
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# Agenda

- Introduction of IdaTech
- Product Introduction
- Fuel Cell System Overview
- Integrated Safety Devices
- Identified Codes and Standards Referenced in IdaTech Designs
- Third Party Evaluation
- Conclusion

# IdaTech Overview

- Founded in 1996 as Northwest Power Systems
- Currently employs 75 Employees
- IDACORP, Inc. (NYSE: IDA) purchased majority share in 1999
- Core competencies are fuel processing technology, fuel cell system integration & controls
- Intellectual Property: 13 Patents, >50 in Process
- More than 25 systems operating in Japan, Europe, and North America (1 & 5kW)
- Commercialized Fuel Processor Module (FPM-20)
- Developed and Tested PV/FC Hybrid Solution
- IdaTech's Functional Organization
  - Engineering & Advanced R&D
  - Operations - Manufacturing & Service
  - Finance & Administration
  - Marketing & Sales
  - Business Development & Government Programs



Mt. Bachelor from Todd Lake

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# IdaTech Products



**FPM 20™ Fuel Processor Module**  
Part of IdaTech's family of fuel  
processors  
\*\*\* Commercially Available \*\*\*



**FCS 1200™ Fuel Cell System**  
Field Test Available  
Targeted Availability Early  
2003



**FCS 5000™ Fuel Cell System**  
Undergoing field-testing

# **FPM 20™ Fuel Processor Module**



*Entry level fuel processor powers 2 kW fuel cell*

## *Specifications*

- Fully packaged subsystem
- Production rate >30 slm (rated at 20 slm)
- Fuel consumption 2.0 L/hr (0.53 Gallons/hr)
- >99.9% H<sub>2</sub> with <1 ppm CO, < 3 ppm CO<sub>2</sub>
- Exhaust: Flow=22 L/sec, Temp=77C max (46 cfm, 170F)
- Quiet operation <50 db at 1 m (39 in.)
- 31 x 37 x 47 cm (12 x 14 x 18 in.); 36 kg (70 lbs)
- RS-485 communication interface
- Operates on methanol/de-ionized water mix



# FCS 1200™ Fuel Cell System



## *Specifications*

- Rated 1.2 kW, 1 kW continuous output
- Fuel consumption 1.3 L/hr (0.35 Gallons/hr) operates for 8 hours using standard fuel tank
- Exhaust: Flow=71 L/sec, Temp=60C max (150 cfm, 140F)
- Mass 100 kg (220 lbs.)
- Dimensions 81 x 60 x 50 cm (32 x 24 x 20 in)
  - Load following
  - Grid-Independent/Grid-Connected/PV-Connected
  - 1.0 kWe net continuous
  - 1.5 kWe peaking (w/battery)
  - $\eta_e = 0.29$
  - 200 watt parasitic
  - Ballard Nexa™ Fuel Cell
  - Remote monitoring
  - Remote Start/Stop

# **FCS 5000™ Fuel Cell System**

## *Specifications*



- 5 kW fully integrated CHP Fuel Cell System
- Rated 5 kW, 3.4 kW continuous output
- Fuel consumption 2.2 L/hr (0.58 Gallons/hr)
- Exhaust: Flow=57 L/sec, Temp=70C max (120 cfm, 160F)
- Mass: 304 kg (670 lbs.)
- Dimensions: 92 x 67 x 155 cm (36 x 27 x 61 in.)
  - Load following
  - Grid-Independent/Grid-Connected
  - 3.0 kWe continuous
  - 10.0 kWe peaking (w/batteries)
  - 1.2 kWt (cathode only)
  - $\eta_e = 0.36$
  - $\eta_{\text{CHP}} = 0.45$
  - 250 watt parasitic
  - UTC Fuel Cell
  - Modular architecture
  - Remote monitoring

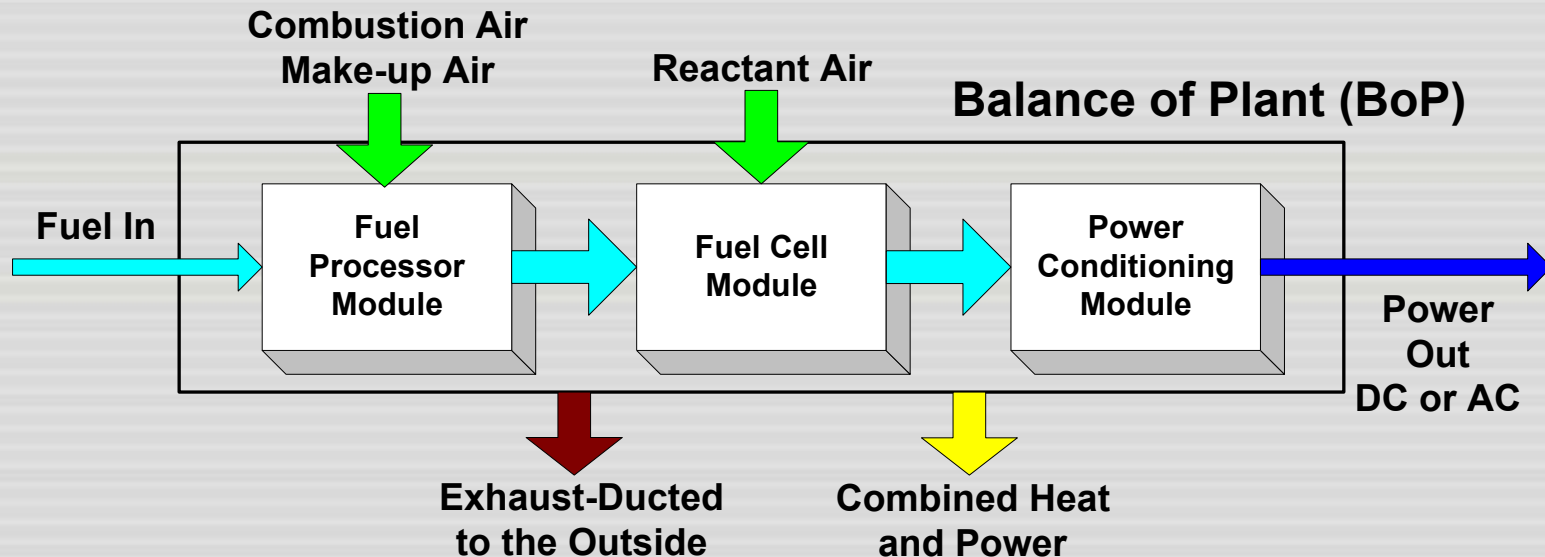


# Agenda

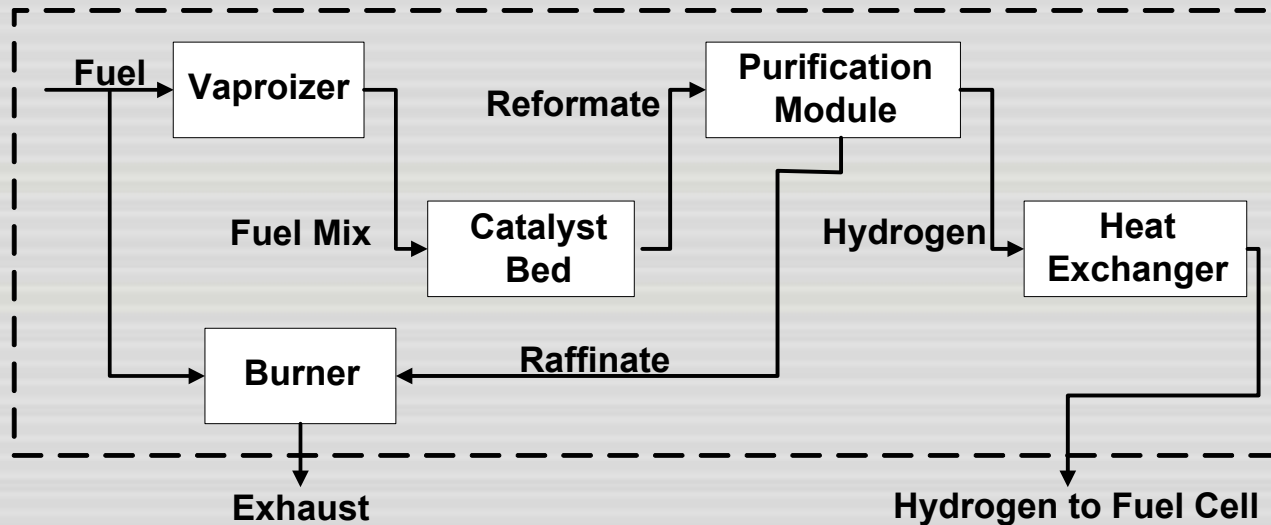
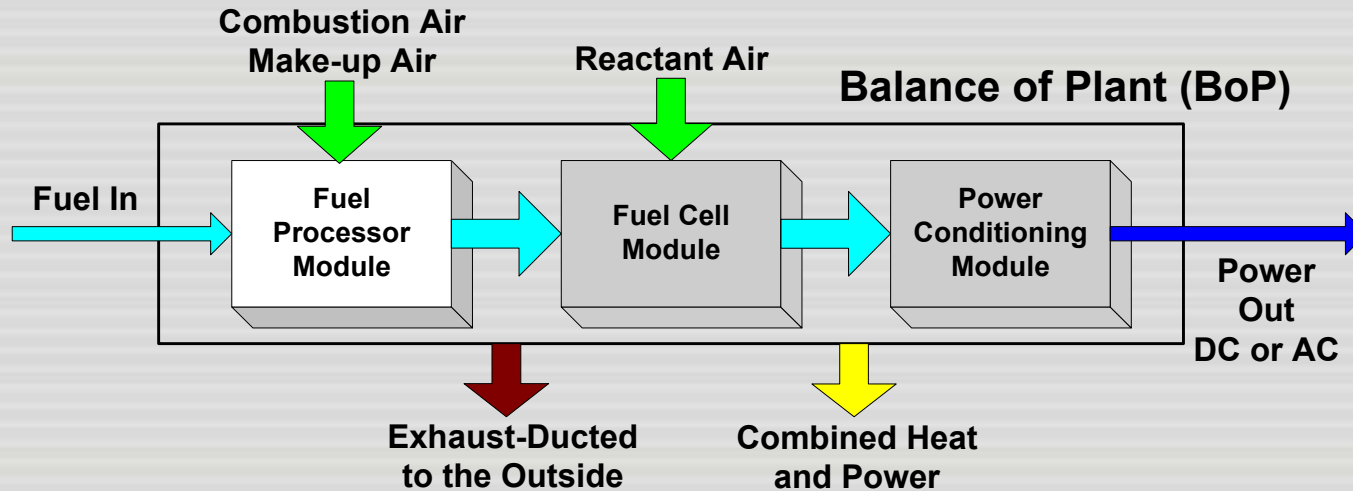
- Introduction
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# PEM Fuel Cell System (FCS)

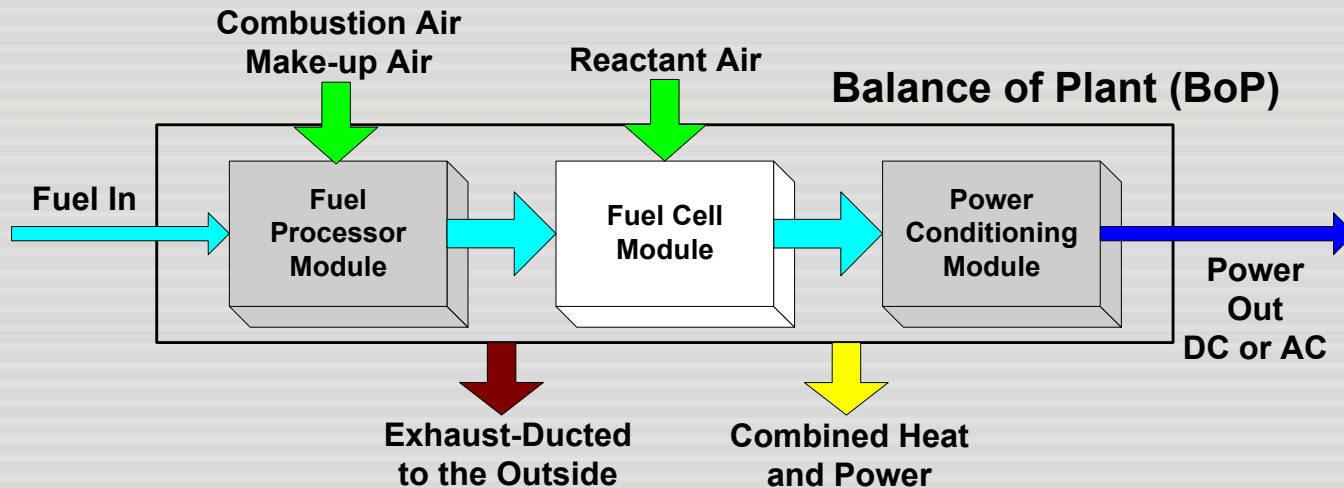
- **Inputs**
  - Fuel: Hydrocarbons or Alcohols
  - Ambient Air
- **Outputs**
  - Exhaust: Water Vapor and Carbon Dioxide
  - Power: Grid Independent or Grid-Connected



# Fuel Processor

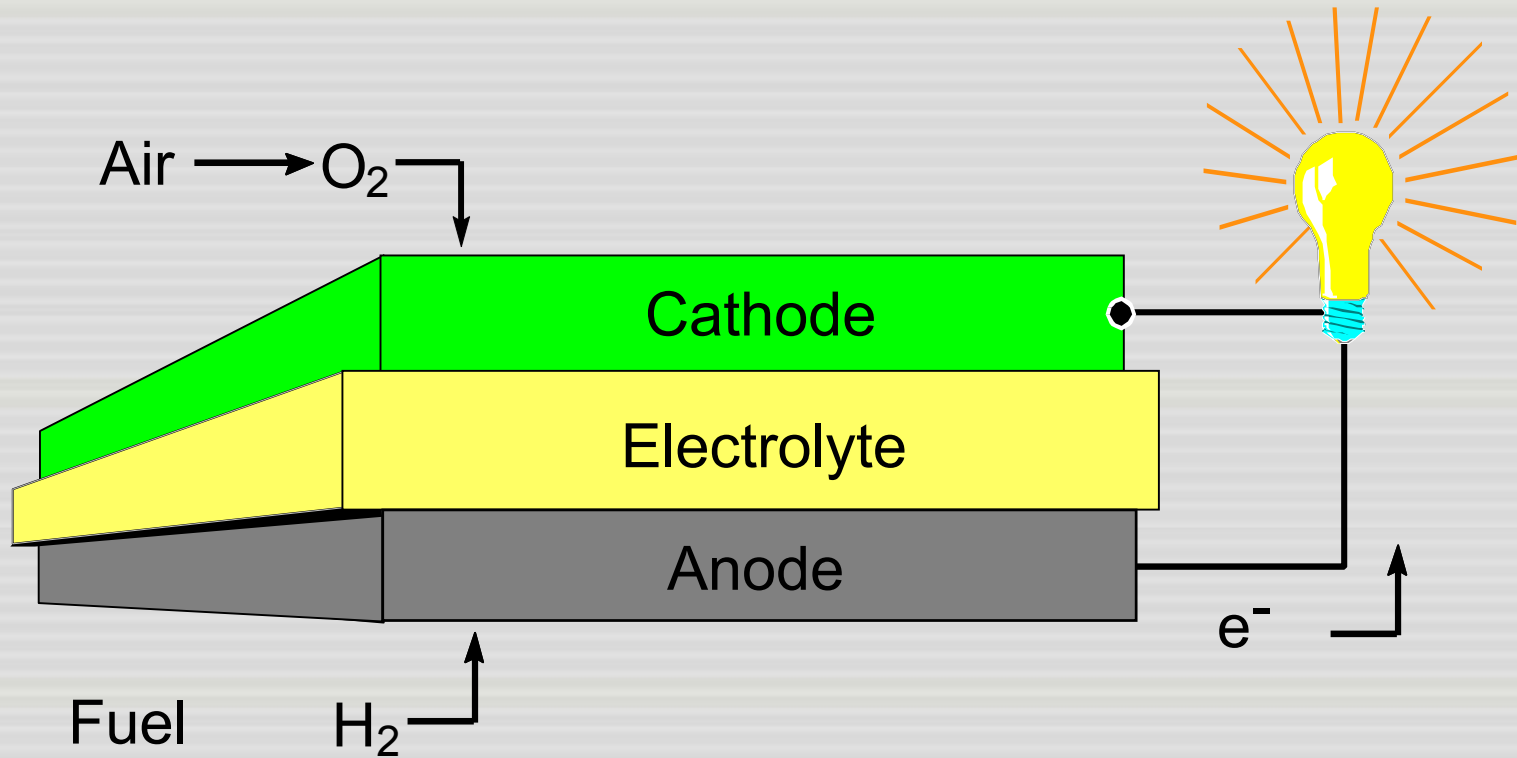


# Fuel Cell Module

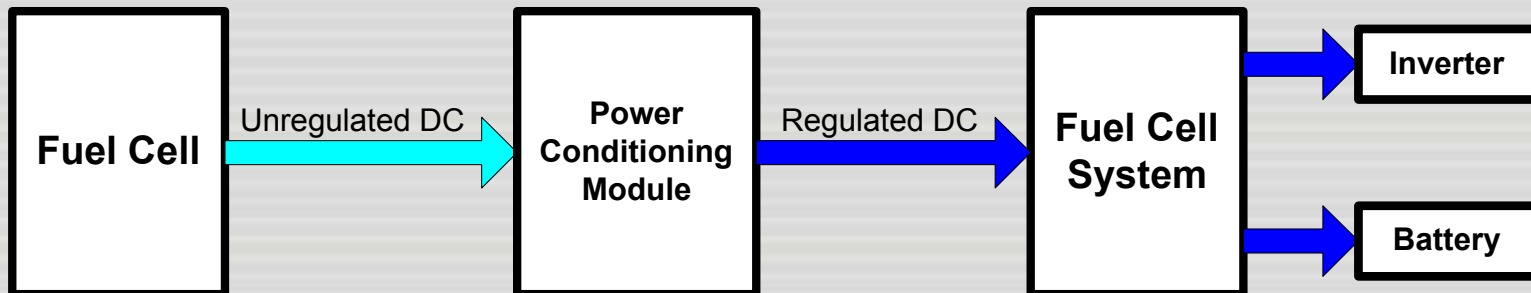
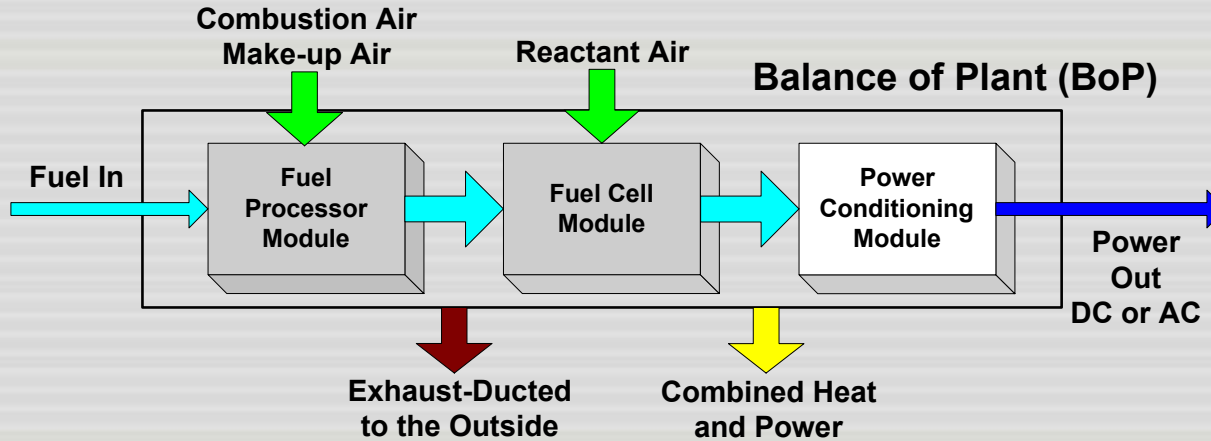


- Electrochemical Process
- Direct Conversion to Electricity
- $2\text{H}_2 + \text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{Electricity} + \text{Heat}$
- Continuous as long as Air ( $\text{O}_2$ ) &  $\text{H}_2$  are provided

# Fuel Cell Technology



# Power Conditioning Module





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# **Safety Devices**

- Breakers and Fuses
- Fuel Leak Detection
- Internal Hydrogen Sensor
- Cabinet Temperature Sensor
- Intrinsically Safe Ventilation System
- Carbon Monoxide Detector/Alarm
- Combustible Gas Detector/Alarm
- Emergency Stop Button

# **Safety Devices (continued)**

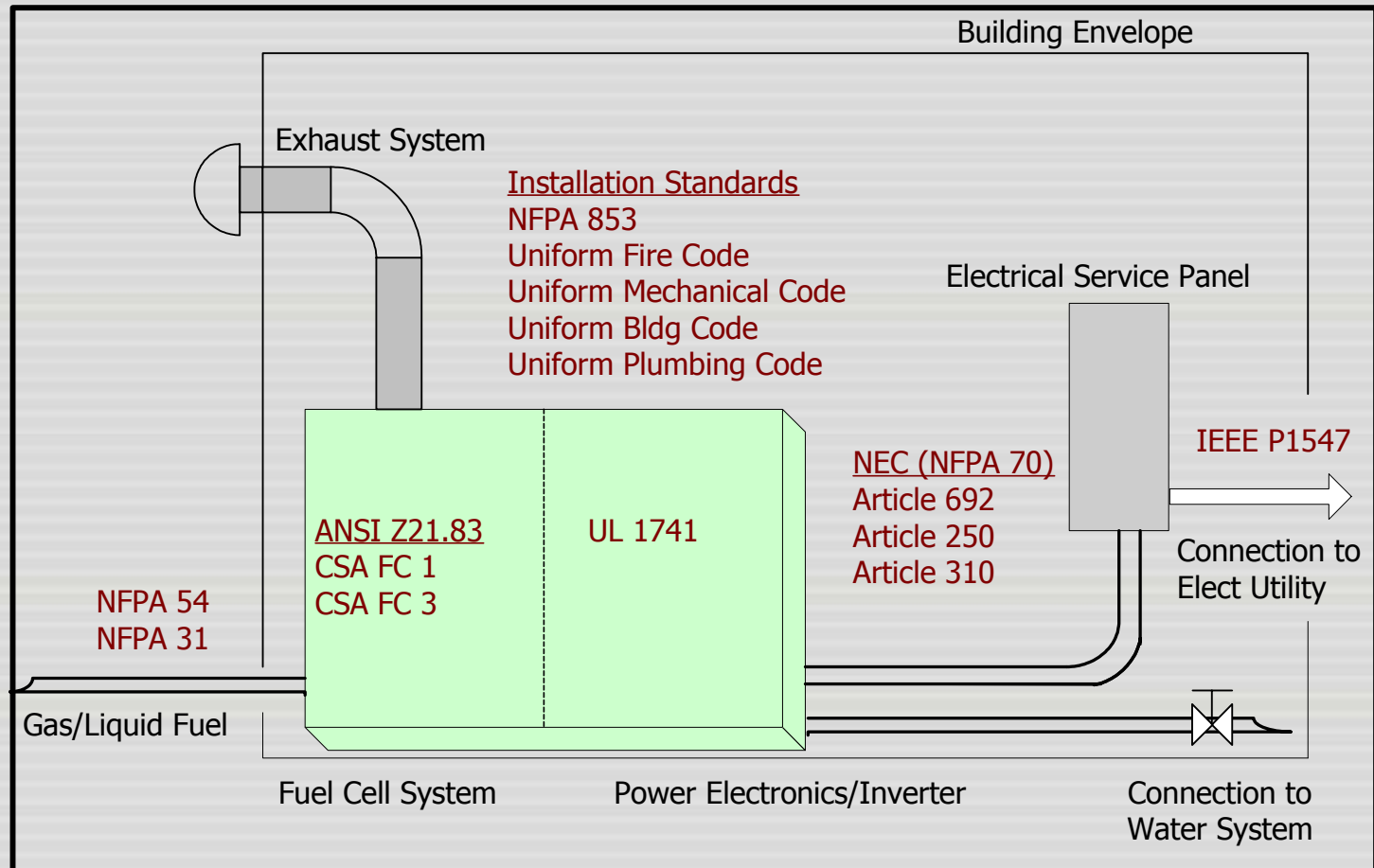
- Redundant, Normally Closed UL Listed Valves for the Fuel Supply
- Redundant, Manually Operated Fuel Shut-Off Valves
- Software Safety Devices
  - Pressure
  - Temperature
  - Humidity
  - Current
  - Voltage
  - Air Flow
  - “Event” Timers
  - CPU “Watch Dog”

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# Interfaces

## Stationary Fuel Cell System



# Product Standards

## Used to Certify Equipment

- **ANSI Z21.83** - Standard on Fuel Cell Power Plants. Scope includes stationary FCS. Currently addresses natural gas and propane fueled systems.
- **ANSI CSA FC 1** - This proposed standard will replace Z21.83 and be broadened to include most types of fuels, gas and liquid, hydrocarbons and alcohols.
- **ANSI CSA FC 3** - Draft Portable Fuel Cell Power Generators. Scope includes portable FCS.



# Installation Standards

## Used to Install Equipment

- **NFPA 70** - National Electrical Code, Article 692
- **NFPA 54** – National Fuel Gas Code
- **NFPA 58** – Liquefied Petroleum Gas Code
- **NFPA 31** – Installation of Oil-Burning Equipment
- **NFPA 853** – Installation of Stationary Fuel Cell Power Plants. The scope of this standard is for FCS exceeding 50 kW. Work is in progress to revise this standard to include all Stationary Systems (removes the 50 kW clause). Available for public comment through October 4, 2002.

# Interconnection Standards

## Grid-Connect and Grid Independent

- **UL 1741** – Standard for Inverters, Converters, and Controllers for use in Independent Power Systems. Scope includes both Grid-Tied and Grid Independent systems.
- **IEEE P 1547** – Standard for Interconnecting Distributed Resources with Electric Power Systems. Scope establishes criteria for interconnection of Distributed Resources with Electric Power Systems
- In the future these two standards will be harmonized, however IEEE P1547 is still a work in progress. At some point the work done in P1547 will be adopted into UL 1741.

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# Field Evaluations

A successful “Field Investigation” performed on  
IdaTech’s FCS-5000 used the following Standards:

- **UL 2262** – Outline of Investigation on PEM type Fuel Cell Power Plants. This is an internal (UL) document developed to help the NRTL assess PEM fuel cells. It is not a national standard and will go away once the proper national standards are developed that cover this topic.
- **ANSI Z21.83**
- **NFPA 70**

# **Field Evaluations (continued)**

## **Focused on the National Electrical Code – 2002 Edition**

- Grounding-Article 250
- Guarding of Live Parts-Article 110-27
- Overcurrent Protection-Article 240
- Wiring Ampacity-Article 310
- Wiring Methods-Article 300

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# **Conclusions:**

## **Fuel Cell Technologies :**

- Fuel cell technology is progressing down a path toward commercialization...most near-term sited units will be for demonstration purposes.
- Collaboration needs to accelerate between code officials and industry in order to properly prepare for the future of fuel cell technology.
- The industry and manufacturers need continual feedback and input from federal, state, and local agencies.
- Overview of the FCS 1200 fuel cell system on display today.